REPORT OF THE COUNCIL.

SINCE the Annual Meeting of the 24th of May, 1892, the Academy has lost by death eighteen members; — nine Fellows, John Montgomery Batchelder, Phillips Brooks, James Bicheno Francis, Eben Norton Horsford, Lewis Mills Norton, Andrew Preston Peabody, George Cheyne Shattuck, Henry Wheatland, and John Greenleaf Whittier; five Associate Fellows, William Holmes Chambers Bartlett, Frederick Augustus Genth, John Strong Newberry, William Petit Trowbridge, and George Vasey; and four Foreign Honorary Members, Sir William Bowman, Alphonse Louis Pierre Pyramus De Candolle, Sir Richard Owen, and Alfred, Lord Tennyson.

RESIDENT FELLOWS.

JOHN MONTGOMERY BATCHELDER.

JOHN MONTGOMERY BATCHELDER was born, on October 13, 1811, in New Ipswich, New Hampshire, and died in Cambridge on July 3, 1892. He was a university student at Brunswick in 1831, and also studied civil engineering with Professor Hayward at Harvard University. For many years he pursued the profession of civil engineer at York Mills, Maine; he also practised his profession at Lawrence, Mass., and he had charge of a mill at Ipswich, Mass. His interest in scientific work was recognized by Professor Bache during the period in which he was Superintendent of the United States Coast Survey, and Mr. Batchelder was employed, together with J. E. Hilgard and Joseph Saxton, on elaborate observations to test base-line apparatus. During his connection with the Coast Survey, Mr.

Batchelder made many experimental inquiries, among which were the following: — On the compressibility of rubber. Expansion and contraction of highly calendered paper. On the compressibility of sea water and some other liquids by pressure, and on the effects of temperature in compression in relation to Saxton's sounding instruments. On the use of vulcanized india-rubber in a compression sounding apparatus. On Leonard's dynamometric log for determining the speed of vessels and of currents of water. On the manufacture of braided sounding-line of hemp, saturated with india-rubber. On Saxton's pressure apparatus, and the effect of temperature and rate of cooling when encased in wood. On the effect of inclination on the compensating base apparatus.

In the Coast Survey Report of 1858 it is stated that he prepared ice charts, showing the boundaries of ice during certain years in the harbors of Gloucester, Salem, Marblehead, and New Haven. Professor Bache, in his correspondence with Mr. Batchelder, often expresses very high appreciation of his work and of his abilities.

In 1858 Mr. Batchelder was detailed from the Coast Survey to assist Dr. B. A. Gould in the Dudley Observatory at Albany. His work there, we learn from a letter of Dr. Gould, was "to bring the calculating machine into shape, and also to aid in arranging the telegraphic connections and apparatus." The calculating machine was Scheutz's tabulating engine, and Mr. Batchelder mastered its intricacies and put it in successful operation. The writer of this notice, while a student, well remembers that Mr. Batchelder was pointed out to him as the only man in the country who could work a wonderful calculating machine at Albany.

Mr. Batchelder's mind was essentially scientific; and no one can examine the note-books of observations which he has left without being impressed by his keen interest in the phenomena of nature. Nothing seemed to escape his attention, from the fluctuations of temperature in a well to the quivering of the aurora borealis. In a long series of observations on the temperature of the Saco River, made in 1838, he notes: "I have observed that in extreme cold weather the vapor from the falls has a very sensible effect upon the temperature of the atmosphere, — the mercury commonly standing four or five degrees higher within a few rods of the river than it does at the distance of one fourth of a mile." While at Saco he watched lamprey eels building a dam in the stream, and in an article, carefully descriptive, says: "I noticed in many instances that the heavier stones were lifted by two eels, working alongside of each other, and carried to their

proper places in the structure. Half-bricks weighing two pounds were thus transferred, and many of the stones were of much greater weight." A friend of Mr. Batchelder, a distinguished engineer, to whom these observations on eels were communicated, said in reply: "I have been recently studying cosmic and synthetic philosophy, and looking back, not to final causes exactly where we run plump against the wall, but at any rate some way back, for previous causes and modes of action. Now, I want to know who began, who laid out the work, and acted as boss in the case you describe. From an ex-dam builder."

We repeat this bit of humor to show a peculiar and taking quality of Mr. Batchelder's mind. No matter how dry or technical the business was in which he engaged, he never failed to evoke a sense of humor in those about him. His kindly manner and gentle raillery gave every one an opportunity to effervesce; and no one enjoyed a good laugh more than he who had made the occasion for it. The play of humor in the letters of Professor Benjamin Peirce to Mr. Batchelder, and in the replies of the latter, show this genial receptivity in a marked degree. Professor Peirce's correspondence with Mr. Batchelder extended over many years; and we find the mathematician presenting his theories of tidal action and of cosmical phenomena to the inventor, and the inventor in turn writing of the mechanical appliances which interested his mind so greatly. Thus Professor Peirce, in a letter written in 1855, says: "I highly approve of your dynamometer log, and think it will be of undoubted value. Let me suggest to you to lay it before Bache as soon as possible, for he will find it of the greatest use in the determination of the velocity of currents, and has been seeking this very thing in a totally different way."

In a letter to Professor Joseph Henry, Mr. Batchelder says: "I do not remember any published records of the increase of the temperature of the earth caused by falls of snow and the consequent decrease of radiation. Can you inform me whether such observations have been made? Enclosed is a sheet showing results of observations in my well (at Cambridge, near the Agassiz Museum) during the years 1868, 1869, 1870, and part of 1871; also a rough sketch of the position of the well. Please notice the sudden fall of one degree during the first week in September, 1868, and the sudden rise in the same week in 1870. The observations would have been continued had not the well become dry in consequence of the construction of a deep sewer in the street. If you think that notes of this kind will be of value, I should

like suggestions from you in relation to the proper mode of making them. I suppose the depth should not be great, — say five to ten feet. I propose to drive in the same cellar an iron tube, and allow the thermometer to remain within a few inches of the bottom. The temperature of the surface of the ground should also be recorded. . . . The cost of the apparatus would be about twenty-five dollars, and I should make no charge as observer."

Mr. Batchelder was a contemporary of Agassiz, Wyman, Bond, Gibbs, and Gould, and walked with the men who have contributed so much to make Cambridge a university centre, and aided them often by his practical science. No man ever had greater appreciation of intellectual qualities than he had, and he was always on the lookout for some mechanical paradox to present to his friend, Professor Peirce, or some peculiar fact in natural history to be elucidated by Agassiz or Wyman. Joined to this reverence for pure science was a marked talent for invention. Before 1853 he invented independently the Bunsen burner, which is so indispensable in all laboratories, and which is used so extensively in the arts. His apparatus for deep-sea soundings is still used in the United States Navy, and is highly approved by the British Admiralty. A short while before his death, Mr. Batchelder received from an officer in the English Navy a highly complimentary notice of the performance of his apparatus. His tide-meter for soundings at a distance from the shore has been used by the United States Coast Survey in various places. During the blockade in 1862–63 it was used in eight fathoms of water off Hilton Head, and was instrumental in securing the safety of government vessels. We find among his papers many memoranda in regard to submarine signals, and when he was over seventy years of age he actively carried out experiments on transmitting signals under water by employing water as the medium of propagation of sound instead of the air. By means of the sound of escaping steam he succeeded in transmitting sound over a mile under water. His ultimate object was to give mariners some method of ascertaining the proximity of ships in a fog. The subject of electricity was always a fascinating one to him. In connection with Moses G. Farmer he invented the compound telegraph wire, which consists of a steel core and a sheath of copper. The steel wire was for strength, and the copper covering for electrical conductivity. The inventors made many experiments to coat the steel wire successfully with copper, and finally succeeded. Early realizing the importance, not only of providing telegraphs with a strong wire of good conductibility, but also with an insulator, Mr. Batchelder in-

vented a vulcanite insulator for stringing telegraph wires on poles or other supports. This insulator was used on the telegraph between Boston and Portland in 1853, and between San Francisco and Sacramento in 1854. His electro-magnetic watch-clock is now in use in various places, — notably in safety deposit vaults. The Batchelder dynamometer for the measurement of power was one of the earliest forms of practical dynamometers, and was of very ingenious construction. It was well adapted for the measurement of the power consumed in various forms of mill machinery. Among Mr. Batchelder's other inventions are the following: —

Vulcanite plate electric machine.

Pressure sounding machine.

Tide gauge hydrometer.

Cards for the blind.

Card catalogues for libraries.

Porcelain and iron insulator.

Instrument for drawing curves.

Railway station and starting signal.

Iridium surface copper plates. The first plate of large size, 21 × 16 inches, was exposed twenty-seven years without wax or other preparation, and was found still brilliant and uninjured.

Hygrometer for regulating moisture in closed apartments and in greenhouses.

Oat basket for horses. To keep the feed at a uniform level, to prevent waste, and to allow the horse to breathe freely.

One cannot read the above list without being impressed by the remarkable activity of Mr. Batchelder's mind. His note-books teem with suggestions, and even in his eightieth year he made memoranda and suggestions for future work. The writer of this notice remembers to have received at the same time two letters: one from Mr. Batchelder, then in his eightieth year, in which he asks if it is possible to make a magnet six feet long; and another from Moses G. Farmer, who had been many years stricken with paralysis, and had to be wheeled about in a chair, in which keen interest was expressed in regard to the oscillatory nature of electrical discharges. Thus two life-long friends rose superior to the ills of old age, and manifested a calm cheerfulness and scientific philosophy of life. No one could meet Mr. Batchelder in the closing years of his busy life without gaining a conviction that there was something undying in the spirit that could so cheerfully meet the growing infirmities of age. When his last illness was unmistakably upon him, he took the writer into the cellar, —

picking his steps painfully down the stairway, and saying humorously, "Slow but sure," — in order to show an apparatus for testing the daily variations of the magnetic compass.

Mr. Batchelder was elected a Fellow of the Academy in 1866. He was also a member of the Boston Society of Natural History, of the Boston Society of Arts, of the American Association for the Advancement of Science, of the American Institute of New York, and of the Natural History Society of Portland, Maine.

1893. JOHN TROWBRIDGE.

HENRY INGERSOLL BOWDITCH.

DR. HENRY INGERSOLL BOWDITCH died on January 14, 1892, after a life of unusually varied interests and activities, in the eighty-fourth year of his age. His illness, although not disabling until the last year or two of his life, had been long and distressing, and, with the added infirmities of age, the years of waiting became weary, especially after the death, in December, 1890, of his beloved companion for more than half a century. But he did not lose his cheerfulness or his courage. His generous thoughtfulness of others and his fine serenity of mind remained to the last. As he read or quoted a favorite passage from the "De Senectute," the old fire flashed from his eyes almost undimmed. To those whose privilege it was to be near him the example of his death will always be an inspiring memory.

Dr. Bowditch was born in Salem, Massachusetts, on August 9, 1808. His father, Nathaniel Bowditch, the eminent mathematician, was a man of sterling virtues, whose own early struggles for an education had impressed upon him the value of self-discipline and the vanity of such accomplishments as music, for instance, which he regarded as worse than useless in building up character. He had not, however, the Puritanic or the Calvinistic austerity so common in New England in his day. He believed in young people having a good time in a healthy, sturdy sort of way. Few sons could say as much as Dr. Bowditch said with a good deal of fervor, that the only mistake which his father had made for him, in his estimation, was his attitude towards music. Dr. Bowditch's mother was Mary Ingersoll, the beauty of whose life was reflected in her influence upon her home and her children. Under such parental guidance, and with the companionship of three brothers and two sisters very like him in possessing an inheritance of individuality and force, and all united in a strong bond of family affection, his child-life was ideal.